

**United States Naval Academy
Mechanical Engineering Department
EM371 Introduction to Design**

Catalog Description: EM371 Introduction to Design **Credit:** 3 (2-2-3)

Fundamentals of mechanical design, with emphasis on the design of pertinent machine elements. Topics such as fasteners, springs, anti-friction bearings, lubrication and journal bearings, gearing and shafts are covered. Also included are static and fatigue failure theories.

Prerequisites: EM217-Strength of Materials, EM232-Dynamics, EM211-Statics

Corequisites: None

Textbooks: Robert C. Juvinall, Kurt M. Marshek
Fundamentals of Machine Component Design, 3rd Edition
John Wiley and Sons, Inc

Course Director: Associate Professor Oscar Barton, Jr.

Objectives¹:

1. To provide an understanding of the analysis, design principles and design methodology of ship-board machine components consisting, but not limited to, threaded connections, gear, bearing, shafts and clutches and brakes.

Course Content:

No.	Topic or Subtopic	hrs.
1	Review of Mechanics	6
2	Impact	1
3	Static Failure Theories	4
4	Fatigue Failure Theories	4
5	Threaded Fasteners	4
6	Springs	4
7	Lubrication	1
8	Rolling-element Bearings	1
9	Gears	5
10	Clutches and Brakes	2
11	Computer Applications – Finite Element Applications	10

Evaluation:	YES	NO
1. Quizzes	X	
2. Homework	X	
3. Exams	X	
4. Laboratory Reports	X	
5. Oral Presentations		X
6. Design Reports/Notebooks		X
7. Prototypes/Demonstrations		X
8. Projects	X	
9. any other evaluation tools used		X

Acquired Abilities²:

- 1.1 Students will demonstrate the ability determine forces and moments on machine and frame structures using principles of equilibrium and energy approaches (1,2,3), (a)
- 1.2 Students will be able to compute states of stress and principal stresses for machine and frame structure, and demonstrate an understanding of the difference between these (1,2,3), (a)
- 1.3 Students will demonstrate an understanding of mechanical behavior of both ductile and brittle materials (1,2,3,8), (a)
- 1.4 Students will demonstrate an understanding of static failure theories as a mechanism for computing factor of safety against yield failure (1,2,3,8), (a, b, d)
- 1.5 Students will demonstrate the ability to apply fatigue failure theories as a mechanism for computing the factor of safety against fatigue failure (1,2,3,8), (a, b, d)
- 1.6 Students will demonstrate an understanding of the designs considerations of machine components including threaded fasteners, bearings, shafts, gears, clutches and brakes. (1,2,3,8), (a, b, d)
- 1.7 Students will demonstrate the ability to use computational tools to assist in the failure analysis of machine components (1,2,3,8), (a, b, d)

Date of Latest Revision: 19 NOV 2001

¹ Letters in parenthesis refer to the [Program Objectives](#) of the [Mechanical Engineering Program](#).

² Numbers in parenthesis refer to the evaluation methods used to assess student performance.